Booz | Allen | Hamilton

Booz Allen Hamilton Inc.
1201 M Street, S.E
Suite 220.
Washington, DC 20003
Tel 1-202-548-3343
Fax 1-202-543-7075

www.boozallen.com

January 12, 2003

Office of Naval Research
Ballston Tower One
800 North Quincy Street
Arlington, VA 22217-5660

Attn: ONR 33, CAPT David Comis
Ref: N00014-99-D-0517/0001

Dear Captain Comis:

Booz Allen Hamilton is pleased to submit this Final Requirements Definition Report in accordance with Task One of referenced task order.

If you have any questions please contact Mr. John Scalzo at (202) 548-3343 for all technical matters. For contractual issues, Mr. Ron Cheshire, Contracts Administrator, may be reached by phone at (301) 863-3458, and by e-mail at cheshire_ron@bah.com.

Sincerely,
John C. Scalzo

BOOZ ALLEN HAMILTON

John Scalzo
Task Manager

Attachment:

Second Monthly Report for Technical and Programmatic Support to Office of Naval Research (ONR), Naval Ship Science & Technology (S&T) Division Code 33X

cc: Administrative Contracting Officer, DCMA VIRGINIA, S2404A (w/o attachment)
Booz Allen, Contracts Administrator, Mr. Ron Cheshire

Report Documentation Page

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14. ABSTRACT

The Office of Naval Research (ONR) has a requirement to develop and evaluate supportability alternatives and to develop a support plan for the LSC (X) project. The LSC (X), commonly known as X-Craft, is a high-speed littoral vessel that is being built for the purpose of experimentation and testing. The X-Craft is under construction and is expected to be delivered to ONR approximately October 2004. A support plan is necessary to ensure the X-Craft is properly configured and supported for operational employment. During the early stage after vessel delivery, there is a requirement to manage this plan through a transition period until the designated support manager is under contract and/or provided with the resources to execute the plan.

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LSC (X) Logistics Planning Support

Task 1- Requirements Definition

INDINGS
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Office of Naval Research (Code 33X)
LSC (X) Project Office

12 January 2004

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1. INTRODUCTION

1.1. Purpose

The Office of Naval Research (ONR) has a requirement to develop and evaluate supportability alternatives and to develop a support plan for the LSC (X) project. The LSC (X), commonly known as X-Craft, is a high-speed littoral vessel that is being built for the purpose of experimentation and testing. The X-Craft is under construction and is expected to be delivered to ONR approximately October 2004. A support plan is necessary to ensure the X-Craft is properly configured and supported for operational employment. During the early stage after vessel delivery, there is a requirement to manage this plan through a transition period until the designated support manager is under contract and/or provided with the resources to execute the plan.

1.2. Objectives

The overall objectives of the tasks are:

1) To provide a seamless, fully integrated support system that will be based on maximizing operational effectiveness and minimizing support cost over the service life of the vessel. The support system must be flexible, agile and responsive to the needs of the operators. The objective is customer-focused product support. For systems and equipment that are common to those found on other Navy ships and craft, existing support infrastructure would be used whenever practical. Depending upon whether the system or equipment is common throughout the Navy, and other considerations, some items could be best supported commercially.

2) To provide the X-Craft project office expertise and assistance in executing the support plan. To assist with daily management activities such as coordinating and tracking action items.

1.3. Task Description

The requirements for Task 1are summarized below.

Task 1: Requirements Definition

a. Determine actions necessary for compliance with existing regulations and requirements.
b. Define user operational requirements and Key Performance Parameters (KPP).
c. Develop an operations and management plan.

Sections three, four, and five of this report detail the regulatory and operational requirements as well as key performance parameters for the X-Craft. Section five provides an operations and management plan which identifies the types of organizations that could be used meet each of the requirements. The operations and management plan provides the framework that would be used to develop the logistics support alternatives for Task 2.

2. CONCEPT OF OPERATIONS

The X-Craft will be a “Navy Vessel” as defined in the U. S. Code of Federal Regulations (CFR); specifically, 1) Any vessel owned, operated, chartered, or leased by the U.S. Navy, 2) A pre-

commissioned vessel under construction for the U.S. Navy once launched into the water; and 3) Any vessel under the operational control of the U.S. Navy or a Combatant Command. During its post-delivery operational concept development/experimental phase, it would not fulfill the criteria of a commissioned vessel (i.e., combatants or auxiliaries that could operate in the open ocean, far from home base in a variety of sea states, in support of other combatant forces or shore-based facilities.

The X-Craft will be a high-speed aluminum catamaran that utilizes an advanced modified hull form, advanced waterjet propulsion, drag reduction, and sea state stabilization and survivability concepts. It will displace approximately 1100 tons full-load, be self-deployable, and be of flexible design for spiral technology insertion to include automation and electric technologies where appropriate. X-Craft will have two helicopter landing spots for up to MH-60S-sized aircraft and will be able to support day/night operations. There will be no organic helicopter hangar facilities onboard. X-Craft mission flexibility will be demonstrated through modular mission packages, which will be housed in the Mission Bay of X-Craft in standard Twenty-foot Equivalent Units (TEU) International Standards Organization (ISO) containers. As a test and experimentation platform, X-Craft is designed for a limited service life of five to ten years.

The X-Craft will provide the fleet with an extremely high-speed asset, suitable for force protection and prosecution of asymmetric threats in littoral environments. It will also provide a very capable experimental platform, with an installed sensor package and data networks. It will put to sea many innovative technologies for evaluation, including a high-speed hull form with ride control, mission modularity, prototype aviation facilities compatible with night vision goggles and devices, reduced manning, and construction to the new ABS High Speed Naval Craft code.

3. REGULATORY/CLASSIFICATION REQUIREMENTS

The craft is being built in accordance with American Bureau of Shipping (ABS) rules for High Speed Naval Craft. ONR might maintain the craft “in class” (i.e., as an ABS classed vessel) during its operating life, and if so, would have to comply with the requirements of Part 7 of the rules, Rule Requirements for Survey After Construction. It is critically important that the craft’s port engineering resources be familiar with these rules and the requirements for maintaining ABS class.

The following is a general overview of the ABS survey requirements for an operating vessel.

Annual Surveys – If maintained “in class”, the craft would be required to undergo an annual survey, which should be made within three months before or after each annual anniversary date of the crediting of the previous Special Periodical Survey or original construction date. For vessels on Continuous Survey, all Continuous Survey Requirements for those parts due would generally to be completed each year.

Special Periodical Surveys – This survey is to be completed within five years after the date of build or after the crediting date of the previous Special Periodical Survey. This survey may be commenced at the fourth Annual Survey and be continued with completion by the fifth anniversary date. Where the Special Periodical Survey is commenced prior to the fourth Annual Survey, the entire survey is to be completed within 15 months, if such work is to be credited to the Special Periodical Survey.

Continuous Surveys – At the request of ONR, and upon approval of the proposed arrangements, a system of Continuous Surveys may be undertaken, whereby the Special Periodical Survey requirements are carried out in regular rotation to complete all the requirements of the particular Special Periodical Survey within a five-year period. The proposed arrangements are to provide for survey of approximately 20% of the total number of survey items during each year of the five-year period. Each part surveyed becomes due again for survey approximately five years from the date of the survey and the due parts are generally to be completed each year.

It is recommended that ONR or the craft operator meet with the appropriate ABS officials to determine whether it would be advantageous for the ONR craft to participate in the Continuous Survey program. It should be the responsibility of the port engineer to keep ABS appraised of the crafts schedule and availability for survey.

Drydock Surveys – A Drydocking Survey is to be carried out two times in any five-year period, with an interval not to exceed three years between Drydocking Surveys.

Damage and Repair - All damages that require repair to the following areas are to be reported to ABS:

- Main Hull and Topside Structures
- Main Engines, Generators, and Waterjets
- Bilge, Ballast, and Fire Main Systems
- Emergency Electrical System and Switchboards
- Safety and life saving equipment

If the operators are unsure whether a repair is covered under Class, they should contact ABS for guidance. All repair procedures and details are to be submitted to an ABS technical office for review and approval.

Modifications - ABS is to be notified of all major modifications to the craft. The plans detailing the modification are to be submitted to an ABS technical office for review and approval, and the modification is not to commence until the technical approval process has been completed. Upon completion of the technical review of the modification, the local Survey office is to be notified.

Operational Restrictions - ABS could issue an "Appendix to Classification Certificate," which outlines the assumptions under which the craft would be allowed to operate. As a condition for Classification, the vessel is required to comply with the requirements in the International Code of Safety for High-Speed Craft, 1994. ABS could apply operational restrictions on the vessel in two categories: 1) Normal Operations, and 2) Delivery or Transit Operations. Normal operations consist of operations within the restrictions listed below; and Delivery or Transit Operations are those that require the vessel to exceed Normal Operations limitations.

- Operation in Areas of Icing Conditions – The craft has no ice strengthening and has not been designed to comply with Annex 5 of the IMO HSC Code for ice accretion.

- Route Operations Manual and Permit to Operate – A permit to operate and a Route Operations Manual are to be carried onboard at all times.

- Normal Operations – Normal operations have three basic types of restrictions: restriction of speed, restrictions of route, and weather restrictions.

  - Restriction of Speed – Speed restrictions may be placed upon the craft with respect to wave height. Wet deck and bow slamming is to be avoided.

  - Restriction of Route – The vessel is assumed to be operating within the area specified in a service restriction. This service area restriction is a distance in nautical miles from the nearest harbor or safe anchorage in relation to seasonal zones as defined in the "International Conference on Load Lines," 1966, Annex II. Such restrictions would be subject to negotiation between ABS and ONR or the craft operator. The craft does not have certified radio equipment for sea area A4. Should the craft need to operate north of 70 degrees N or south of 70 degrees S, a direct printing telegraphy should to be installed to the MF/HF radio system.

  - Weather restrictions – The craft is not to leave a harbor when significant wave heights above five meters would be expected.

- Delivery and Open Ocean Transits – Depending upon any possible route restrictions, the craft should be permitted to transit between areas of operation that are in excess of the route restrictions, but may be subject to conditions agreed upon between ONR and ABS.

- Operations Outside of Class – If it becomes necessary for the operator of the craft to use the craft outside of the limitations prescribed in the "Appendix to Classification Certificate," and upon determining the need for this type of operation, the craft operator is to notify ABS and ONR. At that time ABS would determine if the operation could take place under the auspices of Class or if Class would be suspended until the operations are terminated. Following the temporary suspension of Class, ONR might request re-entry into Class. At such request, ABS might survey the craft, and perform other inspections and/or analysis, to confirm that the craft fulfills safety and other relevant requirements. Upon the need to operate the craft outside of Class on a very short-term basis and under Force Majeure situations, a record of the operation is to be indicated in the ship's log and reported to ABS within a reasonable period of time after the operation.

Port State Control/Technical Authority - Naval Sea Systems Command (NAVSEA) Code 05, is the Port State Control and technical authority for the ONR craft. The Navy would determine the appropriate international certifications to be met by the craft. Naval craft are not required to meet most International Conventions and Codes (e.g., as stated in SOLAS Ch A, Part 1, Reg. 3, or MARPOL 73/78 Article 3, para. 3). However, ABS directs the attention of the Navy to the desirability of following these codes, and upon request could base certification on the Conventions and Codes described below:

- International Convention on Load Lines, 1966
- International Convention for Safety of Life at Sea, 1974, as amended
- International Code for Safety for High Speed Craft (HSC Code), 1996
- International Convention on Tonnage Measurement of Ships, 1969
- International Convention for the Prevention of Pollution from Ships, 1973/78, as amended

4. VESSEL ACCEPTANCE REQUIREMENTS

The Navy and ONR have planned to demonstrate the X-Craft formally to the U. S. Navy Board of Inspection and Survey (INSURV) at an Acceptance Trial and Final Contract Trial, as would any Commissioned Naval Vessel or a U. S. Naval Ship (USNS) to be operated by the Military Sealift Command (MSC). The criteria that INSURV uses for these Trials would be the building specifications and the ABS rules for High Speed Naval Craft. The precedent for a Trial of this type has been established through the many years that INSURV has conducted Trials on ships built to ABS rules for operation by MSC. For these Trials INSURV uses ABS surveyors as part of the Trials team. Standard INSURV procedures are identified in formal Naval Instructions promulgated by the Office of the Chief of Naval Operations (OPNAV) and INSURV.

5. SUPPORTABILITY REQUIREMENTS

5.1 Key Supportability Performance Parameters

The key supportability performance parameters should be based on those metrics that are tied to the operational objectives of the vessel, are important to the crew, and are measurable. Typical logistics metrics include:

- Percentage of time free of category 3 and 4 CASREPS
- Mean time to resolve CASREPS
- Spare part fill rates (i.e., the percentage of time a required spare part is in stock)

Developing supportability performance parameters should be an iterative process. Often the determination of metrics before a vessel is operational is difficult. After the vessel has been operational for a period of time the initial metrics may be determined to be either too easily achievable or unachievable. Therefore, the metrics should be revisited after a period of time (e.g., four months). If the metrics are intended to be used as part of a performance based support contract, a good practice is to have an initial period where the contract is cost plus fixed fee in order to give both the government and the contractor a period to assess what level of support is necessary and achievable. The incentives tied to performance metrics should then be negotiated to a Firm Fixed Price contract after this initial period.

5.2. Supportability Requirements

5.2.1. Maintenance Planning.

The purpose of a maintenance plan is to ensure that the craft is maintained to the highest degree of reliability, and that the material condition of the craft meets the requirements of the American Bureau of Shipping (ABS). The performance of predictive, preventive and corrective maintenance is required to maintain the craft's equipment and systems in a high state of readiness. An effective maintenance program would allow the craft to provide continuing operations, prolong the life of machinery, and to preclude the breakdown of machinery, undue overhaul of major equipment, and excessive corrective maintenance. The most effective manner to accomplish these goals is through the use of a formalized automated maintenance management system.

There are various manual and automated maintenance systems used aboard commercial and military ships and craft, such as the U.S. Navy's Maintenance and Material Management (3-M) system, the Military Sealift Command's Shipboard Automated Maintenance Management (SAMM) system, and ABS' SafeNet. One of the major advantages of implementing an automated maintenance system, such as SAMM or SafeNet, is its impact on ABS classification surveys. ABS would approve the maintenance system prior to its implementation aboard based upon the "ABS Guide for Survey Based on Preventive Maintenance Techniques." During craft surveys, this would allow the ABS surveyor to first review maintenance history documentation within the system, rather than ordering costly and time consuming "open and inspection" of various machinery. Therefore, a record of the Original Equipment Manufacturers (OEM) recommended maintenance should be maintained in order to demonstrate its completion to ABS.

An effective maintenance system should have the following features:

- Machinery History – The capability to document all maintenance performed on the craft and its equipment, both corrective and preventive, indicating problems found and solutions or corrections. This feature also should allow the documentation of configuration changes and unclassified CASREPs. The system should also have a means to track ABS survey items.

- Maintenance – A schedule of maintenance actions to be accomplished with specific maintenance instructions, tools and parts required. The maintenance schedule should be developed using the procedures recommended by the OEM, Navy machinery history for similar systems.

- Repairs – The capability to create and update voyage repair requests; and to write, track and document ship's force work lists.

- Parts – The capability to review the parts allowance list for specific installed equipment, review equipment nameplate data, and to requisition parts.

The cost of implementing an automated maintenance management system would have to be investigated further. However, a system such as SAMM is public domain software and available free of charge. Development and maintenance of the data and training of the crew would have some costs involved.

The Shipboard Testing and Inspection Program is another important factor in an effective maintenance program that should be implemented aboard the vessel. Shipboard Testing and Inspection Programs are outside the purview of regulatory bodies. Typically this program could consist of some of the following inspections and surveys:

- Material Readiness Inspection – A program by which the craft's hull and equipment are systematically inspected periodically to document any degradation in performance or condition. Megger checks on all motors and generators, time vs. resistance, Dielectric Absorption Ratio (DAR), and Polarization Index (PI) test readings are typical actions. Test procedures for major propulsion and auxiliary equipment should conform to either Society of Naval Architects and Marine Engineers (SNAME) codes or American Society of Mechanical Engineers (ASME) Performance Test codes (PTC). All other equipment

would be tested in accordance with OEM recommendations. The results of these types of tests and inspections would form the basis of an availability work package.

- Vibration Analysis Survey – A formalized system of vibration analysis either with hard-wired or portable equipment.

- Thermographic Analysis Survey – These analyses may include all electrical group controllers, power panels, lighting panels, switchboards and all thermal insulated surfaces.

- Lube or Hydraulic Oil Testing – Shipboard and ashore testing of critical shipboard fluids. Portable shipboard equipment should be available for limited testing; however, the craft should be provided a commercial or the Navy Oil Analysis Program (NOAP) system for timely fluid analyses.

A condition-monitoring program may be instituted as a part of, or separate from, the periodic inspection and test program described above. A formal condition-monitoring program is another effective tool that allows the crew and shoreside engineering resources to track the real-time operating condition of critical shipboard equipment. The following are typical condition monitoring analysis tools that could be used aboard the craft: Lube oil analysis, vibration analysis, diesel engine trending and performance analysis, diesel coolant monitoring, audio gauging, thermographic analysis, motor insulation resistance, shock pulse measurement analysis, motor current signature analysis, ultrasonic analysis, and electric surge comparison analysis.

5.2.2. Supply Support

Supply support includes the identification of all parts, tools, special equipment, and consumables necessary to perform maintenance activities as well the mechanisms and business processes necessary for procurement.

Typical Naval shipbuilding contracts include detailed requirements for Provisioning Technical Data to be provided by the shipbuilder such as detailed provisioning lists. However, the X-Craft contract only includes CDRLs for an installed equipment list, a set of technical manuals, detailed design drawings, and as-built drawings. Therefore, the major components of each piece of shipboard machinery or equipment should be identified using those documents. From that list the type and quantify of spares necessary for typical shipboard preventive and corrective maintenance should be generated based upon OEM recommended maintenance procedures. In addition, the type and quantity of spares required for shore-based maintenance shall also be identified. Shore-based spares should be determined based upon the probability of failure, criticality to vessel operations, and lead-time required to purchase the spare.

The Navy typically captures the above data in the Allowance Parts List (APL), the Allowance Equipage List (AEL), and the Coordinated Shipboard Allowance List (COSAL). The APL identifies the parts authorized to be stocked onboard the vessel. The AEL provides a list of material necessary to perform a particular shipboard function, such as damage control, boiler water/feed water testing and treatment, galley gear, or items needed to operate an office. The COSAL contains the entire set of APLs and AELs for the vessel and the associated allowance quantities. However, the generation of APLs, AELs, and COSALs may be prohibitively expensive for a single vessel. Entering the supply data directly into automated maintenance

management system (discussed in detail in section 5.2.1) may be more economical and prove more useful to the crew.

Parts within the Navy's supply system could be procured through the Federal Supply System (FSS). Titan, the Prime Contractor for the X-Craft, is required under CDRL 0004 to provide an installed vendor equipment list with OEM and/or Navy Stock Numbers[1] at the time of vessel delivery. Because the vessel is being built to commercial standards it is unlikely that much of the equipment would be listed in the Federal Supply System.

Parts not available within the FSS should be purchased on an as needed basis through commercial sources such as the OEM or a licensed distributor. Widely available items used throughout industry should be purchased on an as needed basis. Specialty items may require a long-term supply contract with the OEM in order to guarantee their availability.

An initial supply of consumables (e.g., rags) should be delivered with the vessel in accordance with CDRL 027. Consumables could be purchased through commercially available sources as required to preclude the initial supply of consumables from becoming depleted.

5.2.3. Configuration Management

Although the X-Craft is a unique vessel, maintaining configuration control should be a concern. Configuration changes to systems due to operator repairs or shipyard modifications should be tracked and documented. Maintaining control of system configuration and documenting changes is necessary in order to identify when potential changes could result in unattended impacts to other systems or adversely impact equipment warranties. In addition, the configuration changes have the potential to impact the supply support process. Finally, a record of system modifications should be provided as crewmembers are replaced in order to ensure new crewmembers have a history of system modifications.

5.2.4. Human Systems Integration

Because the X-Craft is an experimental high-speed craft the impact on human systems should be evaluated. ABS is currently reviewing the X-Craft design in order to determine whether the design effectively incorporates human engineering elements. In addition, as the X-Craft is placed into operation a plan should be developed determine the impacts of high-speed craft operations on personnel and to identify steps to mitigate any harmful impacts.

5.2.5. Technical Data

The following technical data will be delivered by Titan as part of the X-Craft shipbuilding contract in accordance with CDRL 0004:

- Commercial Technical Manuals with index and Table of Contents
- Installed Equipment List with OEM and/or Navy stock numbers
- Final Approved Detail Drawings
- As-Built Drawings

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[1] *CDRL 0004 specifies Navy Stock Numbers, however the correct terminology is National Stock Number, which the numerology used throughout the Federal Stock System*

These technical data items should be maintained both onboard the vessel within the program office and with other the responsible party for overseeing vessel operations (i.e., the port engineer).

5.2.6. Facilities

Craft Berthing Facilities **-** The X-Craft would require pierside berthing facilities capable of 12-foot draft and 24-foot beam. The berthing facility would require the following services (capacities TBD):

- Potable water
- Shoreside electrical power
- Hazardous material disposal facilities
- Communications connections
- Garbage disposal facilities
- Sewage disposal facilities

The berthing facilities would require cranes necessary to assist in loading a fully loaded TEU container into the X-Craft elevator.

Mission Module Storage Facilities **–** The X-Craft mission modules will be stowed at the facilities of the module owner facilities and the owner would be responsible for transportation to and from X-Craft. Loading the module would require a crane and associated rigging to be arranged by the module owner. The storage facility, depending upon the contents of mission module, would require equipment necessary to maintain the module in operational condition. For example, if dehumidifiers were required the storage facility would require electrical connections.

5.2.7. Manpower, Personnel and Training

The X-Craft will be operated at a reduced manning level. The billets for both the initial Science and Technology Phase and the Operational Phase are identified in the following table:

Science and Technology Phase	
Officers	• Officer-in-Charge (O4/5) • XO/Navigator (O3) • Ops/1st LT (O2) • Chief Engineer (LDO/CWO)
Operations Department	• ETC • BMC • IT1 • ET2 • BM1 • BM3 • QM
Engineering Department	• GSMC/GSEC • GSE1 • GSM2 • EN 2 (2)

The above manning illustrates that the X-Craft crew will be smaller than a typical for a Navy vessel; therefore, the support concepts should be sufficient to minimize the burden on the crew. The crew size requires that the officers and senior enlisted personnel receive orientation training regarding roles and responsibilities for support functions and primary points of contact.

The Engineering Department personnel will be composed of Gas Turbine System Technicians, however, their familiarity with a Combined Diesel or Gas Turbine (CODOG) propulsion system could be limited, especially regarding the operation of the propulsion diesel engines. Therefore, the Engineering Department should receive two weeks of familiarization training on the diesel operation. In addition, the Chief Engineer and the three enginemen should receive two weeks of training on diesel engine maintenance.

Because the X-Craft is an high speed craft the crew members involved in ship handling will require simulation training through qualified activities. This training is necessary to orientate X-Craft ship handlers to the vessel's bridge systems and the unique handling requirements of the vessel.

Besides providing training for the initial crew members, a plan should be developed in order to ensure the proper training is provided to new crewmembers, as the initial crew is relieved. This training may include a combination of shoreside training as well as instruction from the existing crewmembers.

5.2.8. Handling, Packing, Storage and Transportation

The list of necessary spare parts, electronic components, and hazardous materials should be reviewed in order to determine whether any items have special handling, packaging and storage, or transport requirements. This review should result in the determination of special handling requirements and without degradation to sensitive spares or items.

5.2.9. Computer Resources Support

Computer software and hardware should be provided to support and track vessel maintenance, and supply support functions. In addition, software should support other functions such as vessel stability calculations. Maintaining the software is an essential element to maintaining the operational capability of the vessel. Experienced personnel should be assigned, who could provide general support on an as-needed basis. An Information Systems Technician assigned to the vessel would meet this requirement. In addition, specific software support should be available by software vendors in order to address software specific problems. All software agreements and purchases should be reviewed in order to ensure that sufficient support is included.

6. OPERATIONS AND MANAGEMENT CONCEPT

6.1. Vessel Operations

The X-Craft requires shoreside support for vessels operations. Support should address scheduling, fuel and lube oil, personnel administration, and providing necessary facilities. COMNAVSURFPAC, hereafter referred to as SURFPAC, would likely assume operational

control and responsibility for the X-Craft. Therefore it is expected that SURFPAC would provide operations and management support as it currently done for other vessels.

6.1.1. Scheduling

SURFPAC should arrange for vessel berthing, pilots and tug boats to facilitate the safe docking of the vessel. The OIC of the X-Craft will be responsible for coordinating the vessel operations with SURFPAC and communicating vessel requirements (e.g., berthing requirements, necessary tugboats, etc.)

6.1.2. Fuel and Lubrication Oil

The delivery of necessary fuel and lubrication oil should be arranged on a periodic basis. The Chief Engineer would provide the quantities and grades of fuel and lube oil required. In addition, the Chief Engineer would take receipt of the fuel and lube oil upon delivery. This includes verifying the correct grade of oil was delivered. SURPAC should arrange for delivery and payment for the fuel and lubrication oil.

6.1.3. Shipboard Personnel

SURFPAC is responsible for assigning personnel to fill the X-Craft billets and performing all necessary administrative duties for the first two years.

6.1.4. Facilities

SURFPAC should provide pierside and support services, for example: shore power, potable water, garbage disposal, and hazardous waste disposal. Facilities required to support and outfit the X-Craft mission modules would be the responsibility of the commands that would use the mission module. However, commands that may potentially own a mission module (e.g., SEAL Teams) should be notified of this requirement in order to provide them the time necessary to determine and provide the necessary support.

6.2. Port Engineering

It is sound vessel operating practice to have a single person stationed ashore, who is responsible for the engineering operations, maintenance and repair effort, availability planning and oversight, regulatory body compliance, and warranty period management of the craft. This person is typically the port engineer, whose background includes shipboard experience in various engineering capacities, previous port engineering experience with the responsibility of planning and oversight of an availability period including craft dry-docking.

Both military and civilian ship-operating organizations use port engineers. For example, SURFPAC, the proposed craft operator, employs both civilian government employee and contractor port engineers. The Military Sealift Command (MSC) employs civilian government port engineers for their fleet of ships. Civilian ship operating companies also employ their own port engineers, and may employ contractor port engineers if the need arises.

As part of this study, it would be determined whether SURFPAC would provide port engineering resources. If SURFPAC could not provide port engineering services, alternatives exist to ensure

the craft has a qualified port engineer assigned to it. MSC has an infrastructure of port engineering resources throughout the CONUS and also overseas. Private industry ship operators are presently employed under contract with the Maritime Administration (MARAD) to provide port engineering services for MARAD's Ready Reserve Fleet (RRF). Additionally, private firm contractors presently provide port-engineering services to both SURFLANT and SURFPAC fleets.

6.2.1. Ship and Equipment Warranty Period Management

First and foremost, the vessel's warranty period is a contractual issue subject to the requirements of the craft construction contract. The intent of this section of the report is to give guidance and work process flow recommendations for effectively managing the warranty period, without contradicting or circumventing the requirements of the contract. The contract terms take precedence. The terms of the warranty should be reviewed to determine the most effective and complementary support process.

The craft and all of its machinery and equipment are covered by a warranty for a period of 1 year beginning from the day ONR takes delivery of the craft from the construction contractor. It is extremely important that the craft's operator effectively and accurately document machinery and equipment failures during the warranty period. Typically, the vessel operator would assign documentation responsibility to a warranty engineer. Although the overall warranty period management duties would be the responsibility of the port engineer, the craft's Officer in Charge (OIC) and Chief Engineer would be responsible for identifying and documenting warranty items aboard the craft, and for passing the appropriate documentation to the port engineer.

The normal set of duties of the port engineer, the OIC and the Chief Engineer in managing the warranty period are outlined below.

Port Engineer:

- Develop a document/action item tracking system
- Each warranty item identified aboard the craft would be assigned a unique number, have a title which includes the machinery nomenclature and number, short description of the problem, date the machinery failure occurred or was found, date and action taken to correct the problem, cost incurred by the crew and/or service technician to correct the problem.
- Maintain contact with the construction contractor and provide and update warranty failures as required by the contract.
- Maintain contact with the craft Executive Officer and Chief Engineer to ensure that all warranties items are appropriately and correctly documented.
- Arrange for OEM technical representatives to make warranty repairs as required.

OIC:

- Document warranty items for all command, control and communications systems equipment.
- Determine whether repairs should be made immediately to ensure the safe operation of the craft, or whether the repair could be deferred. If repairs are determined to be required immediately, keep track of time and spare parts used to affect the repair.

- Advise the port engineer in the appropriate format of all warranty items and their disposition.

Chief Engineer:

- Document warranty items for machinery and operating equipment other than navigation and command and control systems.
- Determine whether repairs should be made immediately to ensure the safe operation of the craft, or whether the repair could be deferred. If repairs are determined to be required immediately, keep track of time and spare parts used to affect the repair.
- Advise the port engineer in the appropriate format of all warranty items and their disposition.

6.2.2. Voyage Repairs and Availability Planning

The port engineer is responsible for planning and overseeing all repairs to machinery and equipment when the craft is alongside the dock, at a ship repair facility, and during dry-docking. Depending upon the type of work to be accomplished, and whether a repair facility and/or OEM technical representative would perform it; the port engineer shall develop work packages and technical specifications that describe in detail the repair, maintenance, and alterations to be completed. In conjunction with the development of the work package, the appropriate contracting package must be developed in order for the work package to be released to the public for bidding. Experienced port engineering resources would have existing infrastructure and work processes, which would allow it to meet contracting regulations in the advertisement, evaluation and award of a ship repair contract.

Regulatory body requirements, sound marine engineering practices, machinery casualties, preventive and corrective maintenance, and planned craft alterations require the craft to spend time alongside a dock or in a repair facility. During these availability periods, the port engineer is responsible for the oversight of contractor work. It is conceivable that a ship repair facility may work more than one shift to complete the work package. In these cases, an assistant port engineer would be required to oversee work performance during the second shift. The craft operator might assign another port engineer under a temporary arrangement, or the Chief Engineer may be assigned to cover the port engineering duties.

At the conclusion of the availability period, the contracting officer is responsible for the approval of payment of the repair contractors' invoices. However, the port engineer would be responsible for ensuring that each work item is completed in accordance with the work package contract, and that each item is tested and accepted as completed.

6.3. Maintenance Support

Maintenance support may be necessary to perform some maintenance actions that are determined to be too time consuming for a limited crew or require expertise or equipment not available to the crew. Maintenance support may include OEM support or periodic support from Intermediate Maintenance Activities such as SIMA San Diego. The maintenance support provided should be based upon the maintenance plan and an economic analysis.

6.3.1. Intermediate Maintenance Activities

Intermediate maintenance activities could typically provide personnel and facilities to perform maintenance items beyond the capability of the vessel crew. Typical intermediate maintenance items include refurbishing pumps, heat exchangers, and valves. Intermediate maintenance activities typically have shops that are capable of performing maintenance items that are impractical for the vessel's crew (e.g., as rebalancing a pump impeller).

6.3.2. OEM support Contracts

Maintenance contracts with the OEMs of major shipboard equipment might be used for some equipment. The propulsion gas turbines, auxiliary diesel engines, waterjets, radars and other bridge electronic equipment are candidates for OEM support contracts. The advantage of OEM support is that, in many cases, the OEM is best qualified to trouble shoot and repair its own equipment. Another advantage of having an OEM support contract is in reducing the risk of having to negotiate with an OEM to provide repair services after a malfunction has occurred. Negotiating the support contract facilitates having the support available when it is needed. Also negotiating the support upfront provides the government with a stronger negotiating position and helps ensure the government receives a fair price. Generally, equipment that could be repaired only by the OEM should receive the highest priority in negotiating OEM contracts. Equipment where the OEM has an extensive network of repair technicians (e.g., MTU Diesels and GE Gas Turbines) should then be the next priority. Before specific recommendations could be made, a thorough analysis, including cost comparison should be completed.

6.4. Supply Support/Purchasing

Supply support and purchasing support is necessary to ensure that X-Craft personnel have access to the spare parts, tools, and services necessary to support the vessel's operations. This section focuses on the supply support associated with procuring parts, tools, special equipment, and consumables necessary to maintain the vessel in operating condition.

6.4.1. Purchasing

A government contracting officer should maintain ultimate responsibility for the procurement of materials. The X-Craft would purchase materials through both commercial and government organizations. Spare parts that are in the Federal supply system should be acquired through the supply system. Generally, provisioning technical documentation is used to facilitate their supply support processes. However, it might be possible to leverage existing documentation (e.g., Allowance Parts Lists) created for similar equipment installed on other Navy vessels. Parts not currently in the Federal supply system should be purchased through commercial sources or entered into the Federal Supply System. Because the X-Craft is a single vessel, the cost of entering new parts into the Federal Supply System may not be economical. Commercial sources of spare parts could include the purchase of OEM parts as part of an OEM support contract as discussed in section 6.3.2. In addition, the vessel should be provided with a credit card that enables it to purchase commercially available supplies below a predetermined dollar threshold on an as needed basis.

6.4.2. Transportation and Storage

To the extent practicable commercial package delivery services such as UPS or FedEx should be utilized. Generally, high value items with infrequent demand such as long lead-time items should be stocked at a central facility (e.g., an OEM facility) and shipped by airfreight when required. Consumables and low value spares with a greater demand frequency should be shipped by ground transportation and stored on board the vessel.

7. FINDINGS AND RECOMMENDATIONS

The major challenge facing the X-Craft in providing logistics support is that the provisioning technical documentation usually provided as part of a naval ship construction contract was not included as part of the contract for the X-Craft. The lack of provisioning technical data would make using the Navy's logistics infrastructure more difficult. There are two possible solutions to this problem. The first is to purchase the necessary provisioning technical data necessary to integrate the X-Craft into the Navy's support infrastructure. The second is to rely on commercial resources that do not require detailed provisioning documentation. The ultimate solution would likely be a combination of the two, however, that determination could not be made without a detailed analysis. Task 2 requires analysis of government and commercial organizations to identify and evaluate various support alternatives. Support alternatives would be developed using a combination of those organizations needed to provide total support for the X-Craft. The risks, benefits, and rough order of magnitude costs will be identified for each alternative, and a preferred alternative identified based upon the analysis.

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